DOCUMENT RESUME

ED 193 031 SE 032 872

TITLE Population Education in Science: Some Sample Lessons.
INSTITUTION United Nations Educational, Scientific, and Cultural Organization, Bankok (Thailand). Regional Office for Education in Asia and Oceania.
PUB DATE 80
NOTE 57p.: For related documents, see SE 032 869-871.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Elementary Secondary Education: *Environmental Education: *Food: *Natural Resources: Overpopulation: *Population Education: Science Education: *Science Instruction: Science Teachers: Teaching Guides

ABSTRACT

This science teacher's manual contains nine sample population education lessons adapted from materials produced in several countries in Asia and Oceania. Activities are designed for lower primary through high school students. Included are class discussions, small group activities, and a role-playing situation. Food chains, human dependence upon plants and animals, methods for increasing food supply, water pollution, and land resources are among topics investigated. A scope and sequence chart depicts how teachers can integrate population growth and related issues into the regular science curriculum. (WB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED195031

Population Education Programme Service

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

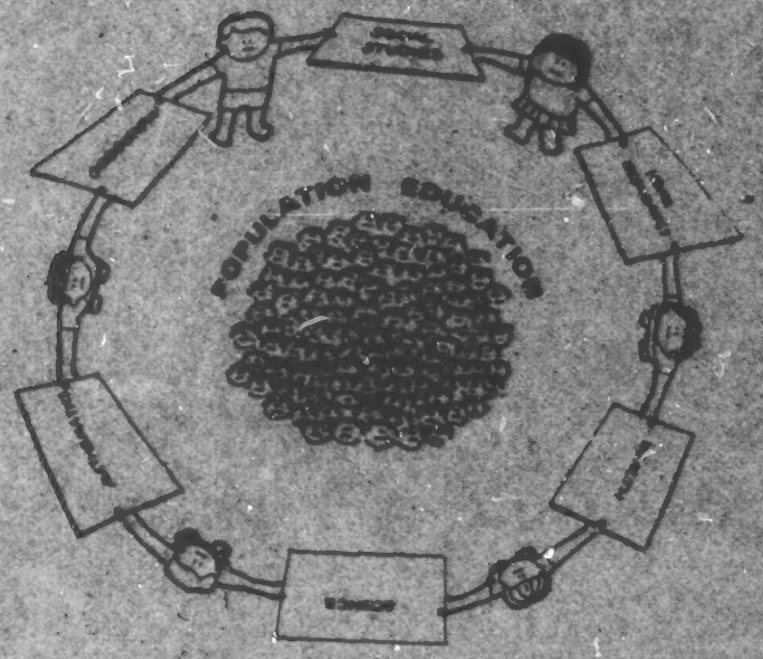
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Carmelita Villanueva

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

population education in SCIENCE

some sample lessons



UNESCO REGIONAL OFFICE FOR EDUCATION IN ASIA AND OCEANIA
Bangkok, Thailand, 1980

ED 032 872

POPULATION EDUCATION IN SCIENCE

General science imparts knowledge of biological, physical and material environments and at the same time develops scientific attitudes such as spirit of enquiry, inventiveness, precision and objective outlook, to inculcate such skills as problem solving and abilities of applying knowledge to life situations. Similarly, population education also works for developing a scientific attitude among the pupils towards life with special reference to environment, reproductive system, health and nutrition aspects and others leading to better quality of life. Two of the sciences that could easily be integrated with population education are natural and medical sciences.

Natural science is concerned with the interrelationship between human beings and the environment. Population growth and distribution and man's capacity to modify and change his environment often threaten to destroy the delicate balance of eco-systems - often to their own disadvantage. Man is the most dynamic element in the ecosystem because he changes most of the other elements in the environment. But there are limits to the change of the environment. As the number of people increases, they begin to need more food, energy, housing, clothing, transport, all of which entail building more factories, nuclear plants, production of fertilizers and pesticides. This modern technology however produces various kinds of pollution which are all beyond the carrying capacity of the environment, thus leading to its deterioration. This type of environmental deterioration is a direct result of modernization occurring in more advanced countries. On the other hand, the problem of environmental deterioration in the developing countries is not due to industrialization but due to their poverty and lack of development such as bad water, poor housing, disease and sickness, lack of sanitation and sewage facilities, inadequacy of nutrition and vulnerability to natural disasters.

The medical/biological sciences on the other hand offer necessary scientific knowledge on human reproduction, pregnancy, the risks associated with the age and health of the mother, her previous history of births and the spacing of her children. Biology, which is a science of living things - plants, animals and human beings - also provides a large number of opportunities for teaching population education. Among these are issues such as the capacity to move from one place to another, growth and development, different parts of the plants and animals and their functions including reproduction. More concrete examples would be shown in the following analogies: 'the care of an infant needs during his growth can be highlighted with the growth of a plant from the seedling days to a full grown tree; or the 'closer the plants in the field the lesser is the development and the yield. If the space is greater between plants the growth is healthier and the yield better. Similarly, if pregnancies and births of children are well spaced, then the children will be healthier and taken care of better. The discussion on reproduction among plants and animals can also help the students to know the functions of the reproductive organs and the factors that are responsible for reproductive activity and at the same time relate it subtly to human sexuality.

4. POPULATION EDUCATION IN SCIENCE

CONTENTS

A. Scope and Sequence of Population Education Concepts as Integrated into Science Subject: Consolidated from Scope and Sequence of Science Syllabi of Selected Countries in Asia and Oceania 1

B. Illustrative Samples of Lessons in Science

1. Male and female characteristics in man and in animal (IV.A.4 - Lower Primary) 5
2. Food chains; producers and consumers of food (IV.B.1; IV.B.5; IV.B.6 - Upper Primary) 10
3. Man's demands on the plant and animal system (IV.B.7; IV.B.8 - Upper Primary, Middle, High School). 16
4. Multiplication of living organisms in water (IV.C.4 - High School) 20
5. Utilization of plants and animals by man (IV.D.2 - Upper Primary, Middle and High School) 22
6. Methods adopted by man to increase food supply (IV.D.2; IV.D.3 - Middle and High School) 26
7. Consequences of man's attempts at increasing his food supply on the biosphere (IV.D.1; IV.D.4; IV.D.5; IV.D.6; IV.D.9 - Middle and High School) 34
8. Pollution of the environment - proper manner to use water for washing and drinking (IV.D.7 - Lower and Upper Primary) 43
9. Environmental improvement: using land resources (IV.E.4 - High School) 45

Population Education Clearing House

UNESCO REGIONAL OFFICE FOR EDUCATION IN ASIA AND OCEANIA

Bangkok, Thailand

IV. SCOPE AND SEQUENCE OF POPULATION EDUCATION CONCEPTS AS INTEGRATED INTO SCIENCE SUBJECT: CONSOLIDATED FROM SCOPE AND SEQUENCE OF SCIENCE SYLLABI OF SELECTED COUNTRIES IN ASIA AND OCEANIA

(India, Indonesia, Fiji, Pakistan, Philippines, Republic of Korea, Sri Lanka)

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
A. PLANT AND ANIMAL POPULATION: LIVING ORGANISMS	1. Types of living things. 2. Classification of plants and animals in the environment. 3. Different parts and functions of plants and animals. 4. Characteristics of male and female plants, animals and man.* 5. The family.	1. To define what population is. 2. To identify characteristics of human and non-human population. 3. To identify different types of living things. 4. To differentiate living things by sex and by parts of the body. 5. To develop understanding that human beings belong to animal population. 6. To acquire knowledge about the family as one group of human population.	X X X X X X	 X X X X		
B. INTERACTION BETWEEN LIVING THINGS AND BIOSPHERE/ ENVIRONMENT WITH REGARD TO FOOD CHAIN	1. Producers and consumers of food.* 2. Photosynthesis of greenery plants and its utilization. 3. Relation of water and growth of plant. 4. Relation of sunlight and growth of plant. 5. Food of animal and man.* 6. Food chain and mankind.* 7. Food types, functions of food, food values.* 8. Balanced diet, nutrition.*	1. To discover the interdependence of living and non-living things in the biosphere for survival. 2. To develop understanding that plant needs sunlight and water to grow. 3. To develop understanding that fooods for human beings are made from photosynthesis of plant. 4. To identify names of plants and animals and their food relationships to be able to develop a food chain.		X X X X	 X X	 X X

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
		5. To comprehend the place of plant and animals in a food chain.		X	X	
C. GROWTH AND REPRODUCTION IN PLANTS, ANIMALS AND MAN	1. Composition and reproductive organs of animals and plants. 2. Pollination and fertilization. 3. Fertilization and multiplication. 4. Multiplication of living organisms in water.* 5. Multiplication of living organisms in land. 6. Factors influencing growth and development in plants, animals and human beings. 7. Structure of human body and its functions. 8. Reproductive organs of human body. 9. Sexual characteristics.	1. To identify the different reproductive parts of plant , animal and man. 2. To develop understanding that living things increase in number with passage of generation. 3. To develop understanding that the environment is the major determinant for the multiplying pattern of the living things. 4. To develop understanding of the conceptual scheme on the reproduction and development of human beings.		X	X	X
				X	X	X
						X
					X	X
D. MAN's INFLUENCE ON THE ENVIRONMENT	1. Man's influence on the resources and the environment.* 2. Utilization of plants and animals by man.* 3. Methods adopted by man to increase his food supply.* 4. The upsetting of the balance of nature.* 5. Destruction of natural habitats of other living things.* 6. Over-exploitation of renewable resources.*	1. To develop understanding that man is a constituent of ecological environment and that the number of human population and its activities exerts direct influence on the equilibrium of the nature system. 2. To foster an understanding of methods adopted by man to increase his supply of food and the impact of such methods on plant and animal life.		X	X	X
					X	X

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
	7. Pollution of the environment (meaning, definition, etc.)* 8. Effects of rapid population growth on family needs. 9. Effects of rapid population growth on renewable and non-renewable resources. 10. Effects of rapid population growth on use of agricultural land and forest areas, housing, crowding and depletion of resources, mineral resources, power, etc. 11. Equilibrium in a community.	3. To develop an awareness of the consequences of man's actions on the biosphere in terms of deforestation, irrigation, use of fertilizers, soil erosion, water logging, etc. as a result of his attempts at increasing his food supply. 4. To name six to ten natural resources and to show how rapid population growth and demand for manufactured goods may result in the over-exploitation and/or depletion of mineral resources. 5. To acquire knowledge of the effects of rapid population growth on physical environment and natural resources.	X	X	X	X
					X	X
					X	X
E. PRESERVATION AND CONSERVATION OF RESOURCES	1. Position of man among living things. 2. Role of man in balancing nature, maintaining beauty and soundness, and preventing random killing of useful animals. 3. Steps to maintain a balance of nature, conservation and improvement of environment a. need for conservation b. government policies and laws c. reafforestation d. prevention of environmental deterioration.	1. To appreciate the need for conservation of useful plant and animal life. 2. To identify ways and means of conserving natural resources to promote balance of natural system. 3. To develop understanding of the need for optimum utilization for the present and the future. 4. To develop an understanding of the methods of preventing pollution. 5. To acquire knowledge of the limitation of basic resources.			X	X
				X	X	X
					X	X
				X	X	X
					X	X

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
	4. Improving quality of life.* 5. Environmental improvement and population control.	6. To relate conservation of natural resources and population control as the twin measures to avoid the dangers from rapid population growth.			X	X

CONTENT : MALE AND FEMALE CHARACTERISTICS IN MAN AND ANIMAL

OBJECTIVES:
1. *To identify male and female animals through similarities and differences in their body parts.*
2. *To compare the human male and female by pointing out their differences through some of their activities.*
3. *To tell some names given to male and female animals.*
4. *To continue applying process skills as observing, describing, comparing, and classifying.*

GRADE LEVEL: LOWER PRIMARY

SCOPE & SEQUENCE NO.: IV.A.4

Instructional Procedure

A. Maleness and Femaleness in Animals

Vocabulary

For man
male - female -

For animals	Male	Female
chicken	rooster	hen
duck	drake	duck
goat	billy goat	nanny goat
carabao	bull	cow
dog	male dog	bitch
horse	stallion	mare
pig	boar	sow

Concepts:
1. The maleness and femaleness of animals are identified through their genitals.
2. There are other characteristics of maleness and femaleness in animals.

Activity 1

Processes
Observation
Description

Suggested Materials
Live pairs of animals or pictures of the following:

dog and bitch	billy goat and nanny goat
bull and cow	rooster and hen
stallion and mare	drake and duck
boar and sow	

Start this activity by asking the pupils:

Who among you have animals at home? What animals do you take care of? Can you tell whether it is male or female? How? Is it always easy to tell whether an animal is a male or a female? Why or why not?

Would you like to know more about some animals? Let's go to a place where we can observe them.

Discuss the field trip plan with the children. Talk about what they will do and set up standards that may guide them in observing well and behaving properly. Then go on a field trip, if possible, to a place nearby where the children can observe live animals like those mentioned in the suggested materials or any other pairs of animals whose physical features are so pronounced that the children will be able to differentiate the males from the females. Divide the pupils into groups. This will help make the management of the field trip easy. Assign each group to observe a pair of animals. If time allows, rotate the groups to enable them to observe as many pairs of animals as possible.

In case a field trip is not possible, assign the children to observe their pets at home or some animals in their neighborhood and to note the male or female characteristic of each animal.

Activity 2

Suggested Materials

Pictures of the animals used in Activity 1.

Start the activity by recalling the observation of animals made during the field trip. Have them bring out their records to help them in recalling what they observed.

Then display in pairs the enlarged pictures of animals where everybody can see them and say:

These are some of the animals we observed yesterday. Let's play a game. Let us find out if you still remember which of these animals are partners. I'll start with the mare. Who can find the partner of the mare?

Call on the children until all the pictures are paired off with males on the right of the females. The pictures, in pairs, may be tacked on a board.

Call on several pupils and have them describe each pair of animals. Have them note the different body parts of each pair. Ask them to tell and explain in what ways the animals are similar or different. What is found in one that is not found in the other? Which of the pair is male? Which is female?

Lead the pupils to identify the maleness and femaleness of the animals through their genitals by calling attention to the pictures of the pairs of animals whose genitals are clearly seen. Bring out how the following will help one determine the maleness and the femaleness of animals: penis, testes, mammary glands, etc. Ask questions like:

What can you say about these animals in the left column? What do we call the first animal? The second? Etc. How about those in the right column? What do we call them? Why? What is found in the animals in the right column that is not found in the animals in the left column?

Now call the pupils' attention to the pictures of the rooster and the hen and of the drake and the duck. Let them observe closely each pair and find out if they can tell the differences between the males and the females even if their genitals are not seen. Ask the pupils:

What can you say about the head of the rooster (drake) and that of the hen (duck)? The tail? Etc. Compare the body parts of each partner. Are they similar or different? Can you tell which is male? Female?

Referring to all the pairs of animals on the chalkboard, ask the pupils:

If we were to group these animals into two, how will you group them? How can you tell which animals are males and which are females? Sum up the activity by helping the children state the following concepts:

1. The maleness and femaleness of animals are identified through their genitals.
2. There are other characteristics of maleness and femaleness in animals.

Topic B. Maleness and Femaleness in Man

Concepts: 1. Some children are boys, some are girls.
2. The maleness and femaleness of children are identified through their work and play activities.

Activity 1

Processes

Observation	Comparison
Description	Classification

Suggested Materials

Pictures of:

1. A boy playing soldier
2. Boys playing with tops
3. Boys working in a cornfield
4. Boys helping their mother wash the dishes
5. Boys flying kites
6. A girl playing with a doll
7. A girl playing with kitchen utensils
8. A girl helping her father build a fence
9. Girls playing "jump the spine"
10. Girls playing baseball.

Start the activity by calling a boy to stand in front of the class. Then ask:

Who is this child? Is he a boy or a girl? Explain your answer.

Some possible answers and their explanations are:

He is a boy because he wears pants, a shirt, and boy's shoes.

He is a boy because he has short hair, etc.

Then request a girl to stand in front of the class. Say:

Who is this child? Is she a boy or a girl? Explain your answer.

Some possible answers and their explanations are:

She is a girl because she wears a dress.

She is a girl because she has ribbons on her hair.

Go on and ask:

What can we say about these children? Why do you say that one is a boy and the other is a girl?

How else can we know whether some children are boys and some are girls? Let's try to find out by observing them well.

Ask them about their activities. Have several boys answer the following questions:

What games do you like to play? What work do you enjoy doing? Why do you enjoy playing those games? Why do you like doing those things?

Ask several girls the same set of questions.

Do you enjoy playing the same kind of games? Do you enjoy the same kind of work? Let's go out and observe children at play. Do you enjoy the same games which these children play?

End the activity by leading them to state the concept through the use of the pictures arranged in two columns-those of the girls in the right and those of the boys in the left. Ask the following questions:

What activities do we see in the left column? What kind of activities are they? Who enjoy these activities more? Why do they enjoy these activities?

Ask the same set of questions listed above when discussing the pictures in the right column. Then ask:

How do the activities of this group in the left column differ from those of the other group? If we were to group these children into two, how will you group them? Why?

By observing a child at play or at work, will you be able to tell who is a boy and who is a girl? Explain your answer.

Lead the children to state the following concepts:

1. Some children are boys. Some are girls.
2. The maleness and femaleness of children are identified through their work and play activities.

Adapted from: Philippines. Ministry of Education and Culture. Population Education Program. *Teacher's guide in population education for elementary science, grades 1-6.* Manila, 1976, p. 19-23.

CONTENT : FOOD CHAINS: PRODUCERS AND CONSUMERS OF FOOD

OBJECTIVES:

1. *The pupils will be able to identify*
   a) the producers of food
   b) the consumers of food.
2. *Given a list of names of plants and animals and their food relationships the pupils are able to develop a food chain.*
3. *The pupils will be able to state the needs of a green plant for its growth.*
4. *The pupils will be able to comprehend the relationships of the living things to the non-living things of the environment.*
5. *The pupils will be able to comprehend the place of plant in a food chain.*
6. *The pupils will be able to appreciate the importance of some of the interactions among various components of the biosphere.*

GRADE LEVEL: UPPER PRIMARY

SCOPE & SEQUENCE NO.: IV.B.1; IV.B.5; IV.B.6

Procedure:

Step I.

Write on the chalk board the names of a few plants and animals the pupils are familiar with in the school environment. Figure I below suggests how this could be done.

Crow Jak tree Grass

Man Paddy

Pineapple Butterfly Cow

Mango tree Parrot Grasshopper

Paddy bug Guava tree

Gecko Fish

Snake

Dragon fly Kingfisher

Frog Water weed

Cat

Bee Coconut tree

Figure I

Draw the attention of pupils to the names of animals written on the chalk board.

Tell them that there are many nutritional relationships that exist between the animals and the plants mentioned on the chalk board, and in order to highlight some of them ask the questions of the types mentioned below, and discuss answers with the pupils.

1. Name an animal that eats the flesh of another animal.
2. The names of how many such animals are there on the chalk board?
3. Are there animals that depend on plants alone for food?
4. Name an animal that eats both plants and the flesh of other animals.

At the end of the above discussion pupils should know that:-

1. Certain animals eat
   - i) Plants and plant material only - HERBIVORE
   - ii) Plants and the flesh of other animals - OMNIVORE
   - iii) Flesh of animals only - CARNIVORE

Draw the attention of pupils to the list of names written on the chalk board once again.

Step II

Link by drawing a line, the names of two organisms written on the chalk board, which are related to each other with regard to their food. See Figure II below. "Cow and Grass" could be linked in this manner, since the "Cow eats Grass" being a herbivore, hence a relationship exists between the two.

Similarly a linkage is possible between"Snake" and "Frog" since the "Snake" preys on "Frogs". Hence another line could be drawn between these two animals. See Figure II below. Use of coloured chalk is recommended during this activity.

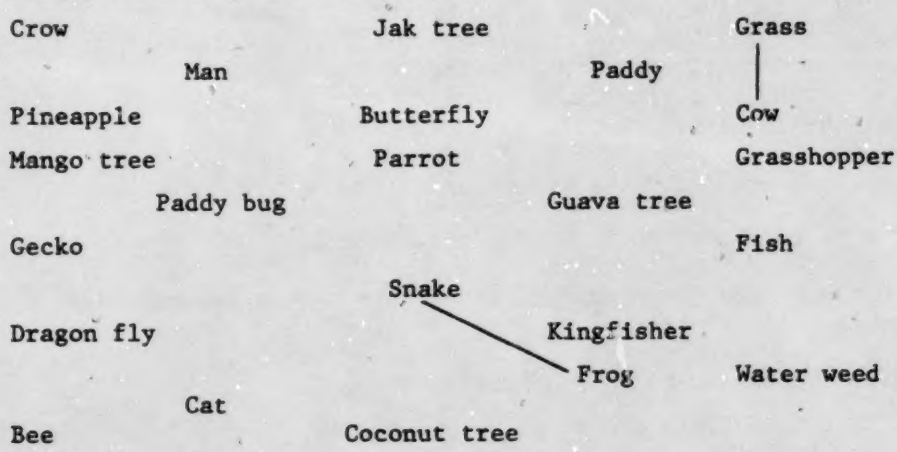


Figure II

Now as an all-class activity ask pupils to come up to the chalk board one-by-one and get them to identify nutritionally-related members or organisms written on the chalk baord and draw lines between them.

At the end of this activity, the completed diagram on the chalk board should show several lines, some intersecting at different points. See diagram III below.

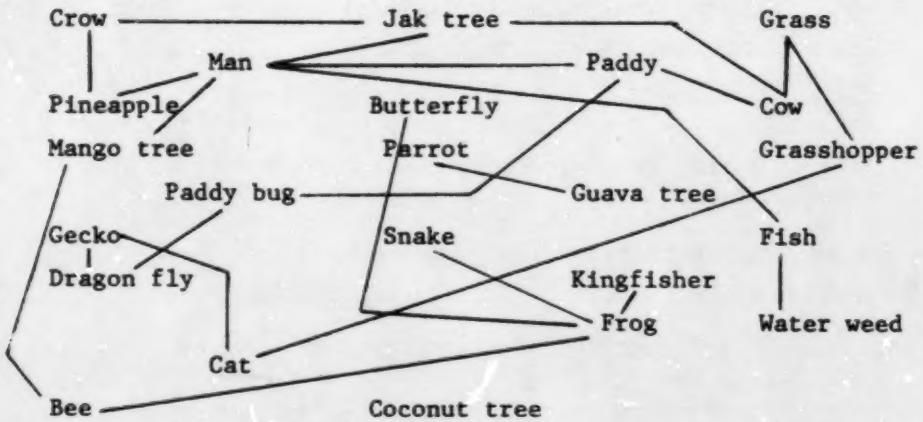


Figure III

Step III

Food Chains

Develop a few (about five) 'chains' as shown below on the chalk board, write names of organism. For example from Figure III above chains such as the following could be developed.

1. Paddy Plant - Paddy bug - Dragonfly - Gecko - Cat
2. Grass - Grasshopper - Cat
3. Mango tree - Bee - Frog - Snake
4. Grass - Grasshopper - Frog - Kingfisher
5. Water weed - Fish - Man

Note to the teacher

In case the pupils had not been taught about food chains before it may be necessary to devote a little more time to it, before proceeding to the next step. Draw attention of pupils to the fact that the food chain beginswith a plant.

Draw pupils' attention to the chains developed on the chalk board.

Discuss with them how these could be developed.

Refer pupils to the first name in each chain. They see that each chain begins with a plant.

The pupils should now be in a position to see that

1. Certain animals are dependent on plants directly for their food.

2. Certain animals are dependent on plants indirectly for their food.

Through a discussion encourage the pupils to discover that a plant soon dies if it receives no water.

Similarly pupils should be able to say that plants do not grow well if they are deprived of manure - (minerals).

Ask them what would happen to green plants if they are kept out of sunlight for a long period of time.

The answers should reveal the fact that such plants may first appear to be pale yellow in colour due to loss of chlorophyll, their stems may become elongated and subsequently die for want of sunlight.

Draw pupils' attention to the fact that few plants grow in the polar regions, as the climate is too cold in these regions to permit plant growth.

The pupils should be told that plants need air for living, just as animals need it.

Now summarize on the chalk board what had been discussed before with them. Write on the chalk board the five basic physical needs that should be provided to the plants for their growth such as:-

i) Water - obtained from the soil
ii) Minerals - obtained from the soil
iii) Warmth - (not too cold nor too hot)
iv) Light - sunlight
v) Air

Elicit from the pupils that plants obtain these needs from the environment in which they grow, and that plants manufacture their own food.

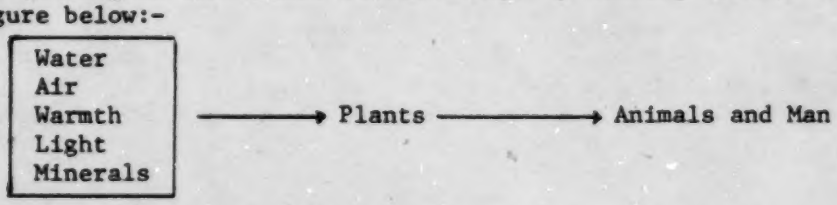
Step IV

Show the possible ways in which plants and animals including man, could be related to each other. Also show how they could be related to their environment. For this purpose make use of the model developed below.

Draw the diagram of the model on the chalk board.

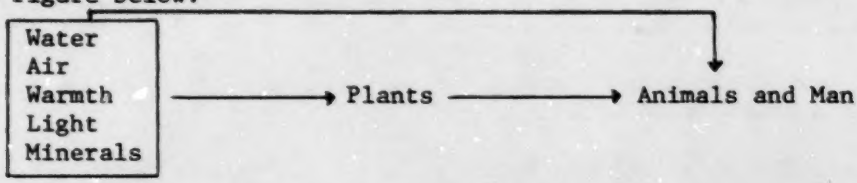
Recall the nutritional relationships that exist between animals and plants and that of plants and the environment. The latter provides the basic needs for the plants to grow.

On the diagram show these relationships by drawing arrows. See figure below:-

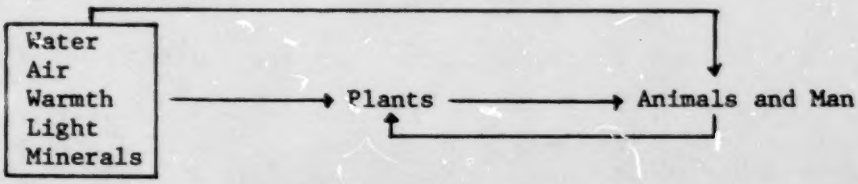


Elicit that animals including man need air for breathing, water for drinking. They need warmth and light too. These are available in the environment in which they live. The environment too is related to animals and man.

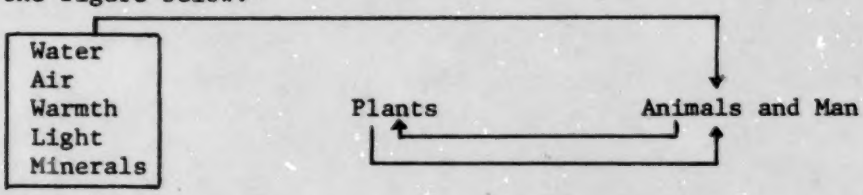
Show this relationship on the diagram of the model by drawing an arrow. See figure below:-



Now ask pupils "How else could animals be related to plants?" The answers should refer to birds building nests on trees, ants building nests using leaves of trees etc. In this manner show how animals could be related once more to plants. Show this relationship by drawing an arrow on the chalk board. See figure below:-



Now find out from pupils how animals could be of any use to plants. Elicit (or state) that animals help plants in the production of seeds, and that animals help plants in getting the seeds spread over long distances. Show this relationship too by means of an arrow as shown in the figure below:-

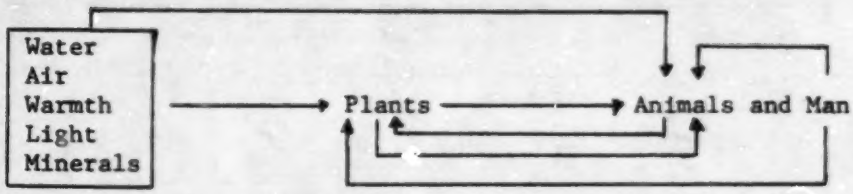


Now elicit the different uses of plants to man in addition to food. Consider the following as some of the uses. If necessary write them on the chalk board.

The uses of plants to man in:-

i) Textile industry
ii) Soap making
iii) Building construction
iv) Furniture making
v) Beauty
vi) Medicine
vii) Fuels (fire wood)

In this manner the pupils should observe the relationship between man and plants. Show this relationship by means of an arrow on the diagram as before.

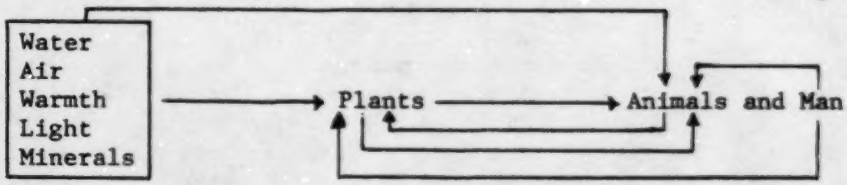


Now ask the pupils how else could animals be related to man. Direct their attention to the important uses of animals to man. Get pupils involved in preparing a list of uses. If necessary put up the list on the chalk board. Given below are some of the uses that could be considered:-

The animals are useful to man in:-

i) The Textile industry
ii) Soap making
iii) Medicine
iv) Transport

Show this relationship as before on the chalk board. See figure below:



Step V

Use the following test-items for re-enforcement and evaluation.

1. Given below is a list of names of organisms found in our environment. Divide them into two groups.

   a) Producers
   b) Consumers.

   Squirrel, banana, water weed, fly, maize, grass, cobra, crane, fish, sugar cane, grasshopper, dog, sweetpotato, caterpillar, hawk, tea, mosquito, moth, carrot, earthworm.

2. Give a single word for each of the following:-

   i) An animal which depends on plant material as well as the flesh of other animals for its food.

   ii) An animal which eats only plant material.

   iii) An animal which depends only on the flesh of other animals for its food.

3. Arrange the following to form food chains:

   i) fox, grass, kingfisher, slug.
   ii) dragonfly, leaves, caterpillar, frog.
   iii) cat, rat, potato.
   iv) plants, snake, fly, frog.

Excerpted from: Sri Lanka. Ministry of Education. Curriculum Development Centre. Population Education Unit. *Man's influence on the resources and the environment; a population education learning unit.* Colombo /1976/, p. 21-29.

CONTENT : PLANTS AND ANIMAL SYSTEM: MAN'S DEMANDS ON THE PLANT AND ANIMAL SYSTEM

OBJECTIVES:

1. *Given the future food requirements of the country according to expected population growth, based on the population and amount of food consumed in a certain year, the pupils recognize that as population increases there is increased demand for food.*
2. *The pupils give the plants and animals from which most of the food items are produced.*
3. *The pupils comprehend that when there is increased demand for food, it results in increased demand for plants and animals.*
4. *The pupils will state the different types of food essential for a healthy life and items of food containing these types of food.*
5. *Given the minimum food requirement of a person and the actual amount he/she gets in some countries, pupils will state the countries in which malnutrition is likely to occur.*
6. *The pupils will comprehend the main reasons for malnutrition and undernourishment in these countries.*

GRADE LEVEL: UPPER PRIMARY, MIDDLE AND HIGH SCHOOL

SCOPE & SEQUENCE NO.: IV.B.7; IV.B.8

Procedure:

Step I

The Bar Charts are put up on the wall and the teacher explains that based on past statistics, the projections of Population Growth for the future years are given. It should also be pointed out that it may happen that these required amounts given for future years will not be available and hence less may be actually consumed. Then few questions will be asked to bring out the point that with the increase in population, there is increased requirement or demand for food. The solution to non-availability of the required quantity of food items also may be discussed. The questions may be framed as follows:

1. Does the Bar Chart showing population growth indicate an increased or decreased or static population for the future years?
2. (a) Is the rice requirement for 1981 more or less than that of 1971?
   (b) Is the rice requirement for 1991 more or less than that of 1981?
   (c) Is the rice requirement for 2001 more or less than that of 1991?

3. What is the similarity you see in Bar Graph I and Bar Graph II?
4. What is the relationship between Bar Graph I and Bar Graph II? Make a generalization.
5. Will the same generalization apply to other food items too?
6. If the required amount of rice or any other food item is not available, can everyone consume the same quantity as before?
7. Mention a food item that is scarce now.
8. Has the price of that increased or decreased or the same now?
9. If the price is high, will all the people be able to buy that food item as before?
10. If a food item that is scarce is rationed, will it help the people? If so, how?

Step II

The pupils are now asked to mention the different kinds of food we eat. It should be recalled that most of the food we consume are from animals and plants. Pupils mention some plants and animals and the products and uses of those. It is concluded that when there is increase in demand for food, there is increased utilization and demand for plants and animals.

Step III

It is explained that though by eating one kind of food like rice, we could satisfy our hunger, we cannot be healthy and have proper growth. We must consume different kinds of food containing different food types that are essential for good health. The important food types are proteins, fats, carbohydrates, minerals and vitamins. Out of these proteins are the most essential for the growth and repair of the body and are called "Body-Builders". The word protein comes from a Greek word meaning "First" and is of the first importance in life of any kind.

The teacher now puts up the chart showing food items which are rich in different food types.

Proteins	Fats	Carbohydrates	Minerals	Vitamins
Meat	Milk	Rice	Milk	Vegetables
Fish	Butter	Wheat	Liver	Fruits
Eggs	Oil	Potatoes	Green	Liver
Beans		Tapioca	Leaves	Fish
Peas				Meat
Lentils				Eggs

Table II

Looking at Table II the pupils answer questions such as follows:

1. The chief food types essential for good health are: ....., fats, ...carbohydrates and .....
2. ....., Eggs and .....contain proteins.
3. Liver contains ..... and .....

4. ....., butter and ..... are fatty foods.

5. Cereals and yams mainly contain the food type called.....

6. Vegetables and fruits are rich in .....

7. Cereals, vegetables and ..... are products of plants.

8. Fish, ...and milk are products of animals.

Step IV

Next, the teacher writes on the chalk board, Table III giving the daily minimum requirement for a person, of some of the food we ought to consume and also the amount consumed in Sri Lanka, India, Japan and North America.

Figures in Grams per Person per Day

Food Item	Minimum Req.	Sri Lanka	India	Japan	N.America
Cereals & Yams	288	435	432	493	321
Vegetables and Fruits	249	159	58	504	485
Meat, Fish Eggs	122	27	8	181	334
Milk	168	54	116	137	670

Table III

The following questions may be asked to elicit the fact that some countries consume more of carbohydrates and less of other food types and in the case of some other countries it is vice versa.

1. Which of the above food items are rich in carbohydrates?

2. Which countries consume more carbohydrates than required?

3. Which of the above food items are rich in proteins?

4. Which countries do not consume a sufficient quantity of proteins?

5. What are the food types consumed in insufficient quantities in India and Sri Lanka?
   The teacher underlines the figures showing it.

6. Which countries consume almost sufficient quantities or more of the food types required for good health?
   The teacher ticks them off.

7. In which countries is malnutrition most likely to occur?

8. Do you think that these countries are rich or poor?

Step 5

A game is organized as a teaching device to help the pupils to understand the factors which could lead to malnutrition and under-nutrition in certain countries and the probable solutions to the problem.

Materials for the game

1. A large playing board prepared on a bristol board or a large sheet of paper with 36 squares. A rectangular strip about 1/3 of a square is fixed on each square, like a pocket, to insert a token card. The number of the square is given on the rectangular strip.

2. A dice.

3. A set of 36 cards (28 cards with statements and instructions and 8 blank cards)

4. 4 tokens (4 cards of different colours and slightly smaller than a square on the playing board)

Procedure

The playing board is fixed on the wall or chalk board so that all the pupils could see it.

The class is divided into 4 groups according to convenience. Each group is assigned a token (a coloured card). The set of 36 cards is distributed so that each pupil has a card. If the number in the class is less than 36, the remaining cards are divided so that equal number of pupils in every group would have an extra card.

If there are more pupils than 36, 4 are allocated to place the tokens and 4, to throw the dice, one from each of the 4 groups.

Before starting the game, the teacher explains the procedure of the game to the pupils.

The game is begun by the first person in one group or the person selected from that group for that purpose. A person throws the dice and announces the number. The person selected from that group or the teacher, inserts the token of that group into the square bearing that number. Then the pupil who has the card of that number reads aloud the contents of the card, and according to the instructions given in that, the token is moved. Now the teacher asks a question or has a brief discussion if necessary on the contents of the card that was read, to make sure the pupils have understood the implications of the statements.

The same procedure is followed by the other groups taking turns.

If more than one group move to a certain number the card bearing that number may be read more than once. If a blank card is arrived at, the token is not shifted. Whether a throw of 6 entitles to a repeat is to be decided upon according to the time available.

Pupils may be permitted to repeat the game later as all the cards may not be selected in one game.

Excerpted from: Sri Lanka. Ministry of Education. Curriculum Development Centre. Population Education Unit. *Man's influence on the resources and the environment; a population education learning unit.* Colo[illegible] [1976], p. 46-51.

CONTENT : MULTIPLICATION OF LIVING ORGANISMS IN WATER

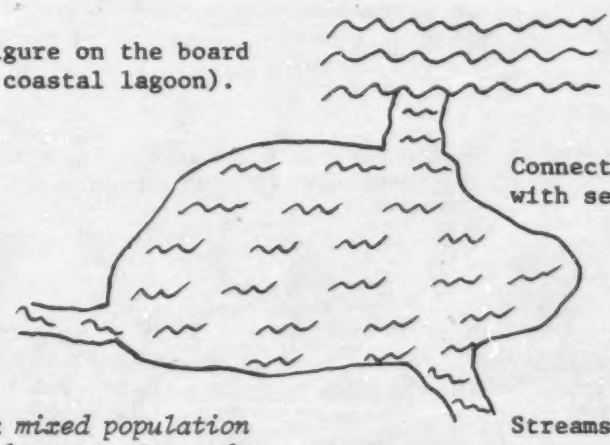
OBJECTIVES: 1. *To give some indication of the relevance of population biology to a practical matter like fish farming.*
2. *To develop understanding that the environment is the major determinant for the multiplying patterns of living things.*

GRADE LEVEL: HIGH SCHOOL

SCOPE & SEQUENCE NO.: IV.C.4

(The material is derived from:- *Pillai, T.G. 1965. Brackish-water fishery resources of Ceylon.* Paper read at the 21st Annual Session of the CAAS).

(Draw a figure on the board to represent a coastal lagoon).



There is a mixed population of fish in the lagoon. Some of them belong to species which are characteristic of lagoons. Others have come in from the sea, and the rest have come along the streams which open into the lagoon.

How might the population of fish increase or decrease?

(Elicit that the population may increase from births and immigration or introduction by man, and decrease from deaths and emigration or capture).

Sand bars are frequently formed at the mouths of lagoons by wave action. The sand bars block the mouth of the lagoon. What might their effect be on the fish population in the lagoon?

(Recall that the lagoon fish consist of a resident population and immigrants from the sea and streams. Sand bars stop immigration from the sea. They therefore tend to decrease the lagoon population, unless the immigrants are predatory species which prey upon the residents. Generally speaking, the fish population increases when sand bars are removed and the connection between lagoon and sea widened. Some types of fishing traps and kraals also hinder immigration of fish from the sea into the lagoon. Prohibition of these would tend to increase the fish population).

Clearing sand bars and other obstructions between sea and lagoon would allow immigration of fish from sea to lagoon. If the block is permanent, we can still grow sea fish in the lagoon if we do some artificial "immigration" by putting suitable sea fish fry into the lagoon. Would you choose first order consumers (herbivores) or higher order consumers (carnivores) for introduction into the lagoon?

(Help the pupils to recall the "energy pyramid" - 100 lbs. producers e.g. algae support about 10 lbs. of herbivorous fish which in turn support only about 1 lb. of carnivorous fish. If there were no carnivorous fish, the 10 lbs. of herbivores would remain. It is assumed here that the acceptability of herbivorous fish as human food is the same as that of carnivorous fish).

But how can we find out which herbivores from the sea will grow well when introduced into brackish water?

(An experimental study is necessary. The fry will have to be introduced into an experimental brackish water farm or lagoon and the yield of the fish determined. The results of experiments done at the Experimental and Demonstration Fish Farm at Pitipane (near Negombo) have indicated that herbivorous sea fish which are suitable for introduction into lagoons as fish fry and fingerlings include milkfish (Chanos) and grey mullet (Mugil). The milkfish breeds in the Gulf of Mannar and the fry can be collected in large numbers from tide pools during certain months. The fry potential at Mannar has been estimated at 400,000,000 per year. Grey mullet fry and fingerlings are also available in abundance).

(Some other biological factors in fish farming include: improving the food supply for the fish by the addition of chemical and organic fertilizers; minimizing predation by carnivorous species of fishes and other animals; prevention of over-fishing).

Excerpted from: Unesco. Regional Office of Education. *Population and family education draft sample instructional materials - science/mathematics.* Bangkok, 1971, p. 17-18.

CONTENT : PLANT AND ANIMAL SYSTEM: UTILIZATION OF PLANTS AND ANIMALS BY MAN

OBJECTIVES:

1. *To be able to list the different products or uses of plants.*
2. *To be able to list th different products or uses of animals.*
3. *To be able to categorize the different products or uses of plants under food, clothing, shelter, medicine and 'other uses'.*
4. *To be able to categorize the different products or uses of animals under food, clothing, shelter, medicine and 'other uses'.*
5. *To be able to trace the ways in which man utilized plants from ancient times to the present day.*
6. *To be able to trace the ways in which man utilized animals from ancient times to the present day.*
7. *To be able to show that as man progressed, he made use of plants and animals for various new purposes.*

GRADE LEVEL: UPPER PRIMARY, MIDDLE AND HIGH SCHOOL

SCOPE & SEQUENCE NO.: IV.D.2

Lesson I - Procedure

It is suggested that this lesson starts with the following activities.

Activity I

The teacher announces to the class that they are going to start the lesson with a game.

The class is divided into two teams A and B in any convenient way. Draw Table I on the Chalk Board.

The teacher has chits giving a product or a use of a plant or animal, rolled out and placed on the table. The first pupil from Team A takes one of the chits and reads out and the teacher writes it on their side of the chalk board. Now the first pupil in Team B names the plant or animal from which the product or use is derived and the teacher writes it on the chalk board, against the product or use given by Team A. Next, the second pupil from Team B picks up a chit from the table and reads out the product or the use of a plant or an animal given in it and the teacher writes it on their side of the chalk board. Then the second pupil in Team A gives the name of the plant or animal for that product or use and the teacher writes it against the product or the use given by Team B. This procedure is repeated for the rest of the pupils in these two teams.

When giving the products or uses, either the parts of plants or animals or the products from those parts may be stated.

If a pupil does not know, it is left blank. At the end of the game, the teacher counts the number of correct answers given by each team and announces the scores.

The teacher now lets the class fill in the blanks. If they fail, the teacher gives the answers. In addition, the pupils are asked to mention wherever possible, other products or uses of each plant or animal already given on the Board and the teacher writes them down.

Next, the teacher asks the pupils to give a few more useful plants or animals and then they give some products and uses of each. These are also added to the list on the Board. The teacher must make sure that all the pupils know from what part of a plant or an animal certain products are derived.

Example: 1. cow - leather, shoes (from the skin of the cow)
2. rubber plant - tyres (from the latex tapped from the tree)

Activity II

The teacher distributes pupil's Work Sheet I and asks the pupils to list the plants and animals given in Table I - (on the board) under 'Name of plant or animal' and categorize the products and uses given, under 'food','clothing','shelter', 'medicine' and 'other uses', as shown in Work Sheet I.

While marking 'other uses' the teacher discusses with the pupils what exactly they are. Products of plants and animals such as chairs, brooms, paper, dye, hand bags, etc., or the purpose for which the plants and animals are used, such as entertainment, (or specifically circus, zoo, riding etc.,) transport, beauty, ornament etc., could be given.

Activity III

Let groups of pupils complete the Pupil Work Sheet through group discussion.

The aim is for the pupils to acquire the ability to trace the ways in which man utilized plants and animals from ancient times to the present day. Therefore, after the pupils finish their Work Sheet, the teacher writes the answers on the Chalk Board thus:

Answers

1. flesh
2. fruits, roots
3. leaves
4. skins
5. skins, wood or timber
6. wood, bulls or horses or animals
7. clothes or garments
8. leaves
9. horses, donkeys
10. plants

The pupils check their answers and correct their mistakes or complete the statements if they had not been able to do so.

Then the teacher has a short discussion with the pupils by asking simple questions to make clear the concepts in the Work Sheet II and to bring out the facts that (i) plants and animals served certain purposes throughout, from ancient times to the present day, though the manner of utilization changed, e.g. plant and animal products which were eaten raw are cooked, processed as by canning, converting to powder forms etc. Plant materials used for building simple houses are now sawn and planned for many uses in building houses and other structures. Many medicines not known of earlier are derived from plants or plant materials.

Man also uses plants and animals for various new purposes, e.g. plants and animals for recreation as in parks and zoos. Plants and animals for

aesthetic purposes (garden plants and pets); products of plants such as latex for industrial uses; perfumes; products of animals such as whales etc., for industrial uses and plants and animals for scientific experimentation leading to new discoveries.

TABLE I

	Team B	Team A		Team A	Team B
	Plants or Animals	Products or Uses		Plants or Animals	Products or Uses
	PLANTS				
1.			2.		
3.			4.		
5.			6.		
7.			8.		
9.			10.		
	ANIMALS				
11.			12.		
13.			14.		
15.			16.		
17.			18.		
19.			20.		

Pupils are asked what they have learnt from this lesson and are helped to make the following generalizations:

i) Man utilizes plants and animals for many of his needs.

ii) From ancient times to the present day man has been utilizing plants and animals.

iii) As man became civilized he began to use plants and animals in various new ways.

Pupils' Work Sheet II

1. The primitive man lived in the Jungle. Just as the carnivorous animals hunted other animals for food, he also hunted animals and ate their .....raw.

2. Like the herbivorous animals, he ate parts of plants also to satisfy his hunger. He ate the .....leaves and .....of plants.

3. He did not have textiles to make garments. He wore ..... round his waist.

4. Not only did ancient man eat the flesh of animals, he also made use of their skins. Since he did not know how to make any material to protect himself from the cold, he made use of the ..... of animals to cover himself.

5. As years passed, man made use of his brains more to improve his way of living. He learnt new uses of plants and animals too. He spread the ..... of animals and mats made of leaves of plants to sit on. Later he learnt to make chairs out of ..... to sit on.

6. When man learnt to cultivate the fields, he made use of ..... from trees to make the plough and used ..... to draw the plough.

7. Man learnt to make ..... out of cotton from the cotton plant and out of silk from the silk worm.

8. Ancient man found shelter in caves and on top of big trees but later he learnt to make huts to live in. He built the walls out of mud or fenced them with sticks and leaves and also thatched the roof with .....from trees.

9. Earlier man carried his belongings on his back. Later, he discovered that animals could be tamed and he made use of animals like ....., ... and camels to carry his goods.

10. As man became civilized, he wished to keep his surroundings beautiful. He grew ..... in his garden to make his home look colourful and pleasant.

Excerpted from: Sri Lanka. Ministry of Education. Curriculum Development Centre. Population Education Unit. *Man's influence on the resources and the environment; a population education learning unit.* Colombo [1976], p. 39-44.

CONTENT : MAN'S INFLUENCE ON THE ENVIRONMENT: METHODS ADOPTED BY MAN TO INCREASE FOOD SUPPLY

OBJECTIVES:

1. *To recognize the need for increasing the amount of land brought under cultivation.*
2. *To be able to name the ways in which water is supplied for agriculture in order to increase food production.*
3. *To relate increased food production with the use of fertilizers.*
4. *To identify different forms of agricultural practices adopted in the area.*
5. *To be able to state that man today is increasingly conscious of the quality of the food he consumes.*
6. *To recognize ways in which man attempts to control other organisms which compete with him for food.*

GRADE LEVEL: MIDDLE AND HIGH SCHOOL

SCOPE & SEQUENCE NO.: IV.D.2; IV.D.3

Preparation of materials needed:

Two copies each of spring board I, II and III should be available beforehand. Get a few pupils to copy out the passages and tables necessary for group work a day or two before the lesson is taught. If facilities permit these could be typed out in advance.

Procedure:-

Step I:- The first step in the lesson is to get the pupils to recognize the following:-

1. the importance of food
2. the amount of food available
3. the increasing demand for food.

The teacher begins the lesson by recalling pupils' previous knowledge on health and nutrition. Stress the importance of food for survival and the importance of food for healthy living. Refer to the local situation and ask questions such as:

- how is food distributed?
- why is rationing of food necessary?

This discussion will show the pupils that though the amount of food have increased, it is not enough to feed the growing numbers.

Continue to lead the discussion by asking a question such as:

- is it merely the increasing numbers that have created a need for more food?

Elicit from pupils the different reasons for the increase in demand.

These could be noted down on the chalk board. Include other additional pupil responses if they are relevant. Where necessary proper guidance from the teacher is important. These responses would be:

- more people to be fed
- people who were underfed are now being better fed
- people eat better food
- people eat more food derived from animals
- import of food being restricted
- need for new substitute foods.

Pupils should be made aware that there is a need to produce more food and new types of food to meet the growing demand.

Step II:-

Teacher probes the issue with the pupils - how man tries to produce more food.

1. by bringing new areas under cultivation
2. by increasing output in already cultivated areas.

The pupils should be drawn into a discussion by which they would be able to point out how new land is brought under cultivation. If the pupils find it difficult to come out with the expected responses, the teacher should guide them with questions such as:

1. Will any type of land help to produce more?
2. What are the conditions you would look for in selecting new land for cultivation?

Answers to the latter question could be:

- selection of new land depends on:
  - fertility of soil
  - availability of water
  - terrain of land
  - distance and convenience
  - transport facilities.

Draw the attention of the pupils to the local situation recalling their observations of their own neighbourhood.

Elicit from pupils at the end of the discussion that when land is cleared and brought under cultivation plant and animal system undergoes a change.

- plants found in the area are destroyed and changed
- animals are displaced and destroyed
- the entire landscape is affected.

Step III

The teacher should discuss whether it is possible to go on increasing the amount of land under cultivation indefinitely. Mention the limited nature of land available to us.

The pupils understand that the best land available in respect of the availability of fertile soil, water etc., has already been made use of by man to produce more food.

Explain that there are other areas where some facilities are lacking, because of which they still remain uncultivated. If one or more of these facilities were available these marginally productive lands too would be brought under cultivation.

Of the facilities man normally looks for which is most vital in bringing land under cultivation?

Their answer would naturally be water supply without which no land however fertile could be cultivated successfully.

The teacher should at this point mention that one of our major problems has been the lack of sufficient water for cultivation in many areas. Though our island is bestowed with a plentiful supply of rain water, it is not evenly distributed. As a result our Dry Zone including Jaffna Peninsula and Arid Zone depend on irrigation for cultivation. Numerous old irrigation works which have now been restored and the new multipurpose schemes help to step up production in areas which would otherwise remain idle.

The pupil should be able to identify the ways in which cultivators obtain water for cultivation in the village, district and country and note that these water bodies use up much land area. Well, tank and channel irrigation are common in Sri Lanka.

Referring to the local situation the teacher should ask questions such as those given below to stimulate a class discussion on observations made by the pupils:

1. What are the ways in which water is obtained for agriculture in your area?
2. What would be the result if the farmer depended only on rainfall for cultivation?
3. Has irrigation helped to increase food production in your area?
4. How does construction of tanks, reservoirs and channels affect the natural vegetation and animal life of the area?

Pupil Activity (optional)

* Name the sources of water supply for your home and school garden.
* Name the ways in which the village farms and fields and the large extent of cultivated areas in the country are supplied with water.

Step IV

The teacher should next proceed to discuss other methods by which man has increased food production. Here again the responses could be listed on the chalk board.

These would be:-

- use of fertilizers
- mechanized agriculture
- better planning and agricultural practices
- selective breeding
- use of pesticides/weedicides to eliminate competition.

At the end of this discussion pupils will know that man has to adopt various other methods to increase production of food.

Step V

Once this has been done the teacher should divide the class into 6 groups. Groups A and B will be given a copy each of Spring Board I (student material). Groups C and D will be given Spring Board II and Group E and F will be given Spring Board III.

(Two copies of each Spring Board should be available beforehand as mentioned earlier. These could be hand written or typed. Get some pupils to copy out the passages and tables a day or two earlier).

Use of Student Materials or Spring Boards

A - Spring Board I is a passage on the use of fertilizers. The teacher should request the groups to read it carefully and write brief answers to the questions.

Focus the attention of the pupils on the local situation and request them to note down their own observations and experiences.

B - Spring Board II is a pupil activity where they fill in the cages after a careful study of the table. Pupils recall their observations of the type of agriculture practised in their own areas. The group should discuss the different forms of agricultural practices and farm management methods before filling in the cages.

The first column give the processes and implements used for the production of food. Many alternatives have been suggested for each item. In the second column, the pupil mentions whichever is applicable to his/her area. In the third column the reason for adopting the method mentioned in column 2 must be given briefly.

In the first column some items are not complete e.g. paddy strains, vegetables etc. Here the teacher should fill in the blanks with 2 or 3 alternatives used popularly in the area, before giving out the material to the groups.

e.g.	paddy strains	-	DD66/BG11/DG34 - 8/.....
	vegetables	-	tomatoes/...../.....
	other crops	-	tobacco/tea/sorghum/.....
	pesticides	-	Endrex/...../.....

C - Spring Board III is also a table to be filled in with relevant information. The pupils should read the passage given along with the table, before attempting to fill the cages. The pupils should discuss the nature of the food consumed in their areas. They should also be aware of the methods adopted by man to eliminate weeds and pests which compete with him in sharing the food he produces.

Pupils in rural areas may have first hand information available to them. But those in urban areas may have to get the help of the teacher.

Step VI

When the six groups complete their activities the group leaders read out their observations to the class. The teacher should analyse the responses and view them objectively. He/she should pin up the completed tables on the Bulletin Board so that all pupils could read them after the lesson.

Knowledge and experience gained in the local situation should be given due recognition and all responses from pupils should be viewed in an unbiased manner.

Spring Board I

a) Adding materials to the soil to improve its productive capacity is an age-old practice. More than 2,000 years ago agricultural civilizations realized the value of animal manures, wood ashes, lime and bone in promoting growth of agricultural crops. The ancient Chinese farmers had evolved one of the most rational systems of using waste materials to maintain soil fertility.

Today modern science after 3 centuries of experimentation has found what the nutrient requirements of plants are.

The elements nitrogen, phosphorous and potassium are referred to as the "Big Three" in plant nutrition. They are needed in large quantities by all crops. No soil in any part of the world can supply the full requirements of these year after year. They have to be supplemented after some time by fertilizers.

Calcium, magnesium and sulphur are some of the other elements required by plants in smaller quantities.

The plant nutrients added to the soil fall into 2 main groups: (i) chemical fertilizers (ii) organic manures.

Chemical fertilizers are concentrated substances manufactured in a factory and are called artificial fertilizers. Organic manure is a bulky material produced in a farm itself especially from cattle dung, crop wastes and residues.

1. Do you use fertilizers in your home garden? Why or Why not?
2. Do you think the soil in the school vegetable garden is rich in plant nutrients?
3. Can forest soil be cultivated year after year without any fertilizers being added?
4. Do you agree that animal manure and other refuse improve the productive capacity of the soil?
5. Can soil fertility be maintained with organic manures alone?

Spring Board II

	Implements and Methods	What is applicable to your area	Reason
turning the soil	- mammoty/ tractor/...		
ploughing	- wooden plough/ tractor (4/2 wheel)		
harvesting	- hand picking/ sickle/ machines		
water supply	- well/tank/ stream/channel		
choice of paddy strain	- ..../....		
vegetables	- ..../....		

	Implements and Methods	What is applicable to your area	Reason
choice of other crops	- single/double/ rotation/relay cropping		
fertilizer used	- artificial/ fertilizer/green manure/cattle dung		
pesticides	- ...../..... ...../.....		
animals reared	- goats/cattle/ horses/.....		
purpose of animals	- milk/meat/other uses.		

Spring Board III(a)

Man has discovered many new ways in which food production is made more efficient. He not only increases quantity but also improves quality. To increase quantity he has introduced fertilizers, insecticides and weedicides and disease control among plants and animals. But to improve quality he has resorted to selective breeding. Use of improved strains of crops and breeds of animals produces better quality food. Controlled animal environments and intensive rearing help to step up efficient production.

To obtain improved productivity the following procedure is usually adopted:-

1. Making life more difficult for predators and competitors by:
   a) spraying crops for weeds, insects and diseases;
   b) animal/house hygiene to prevent diseases.
2. Providing amply for the needs of food plants and animals by means of:
   a) fertilizers and irrigation for crops;
   b) balanced diet and cleanliness of animals.
3. Breeding plants which are better at making food.
4. Breeding animals which are better at converting plant food.

Spring Board III(b)

Fill in the columns with relevant information pertaining to your own area

Food commonly consumed	Sources from which it is obtained	Diseases and pests that affect it	Methods adopted to destroy weeds/pests/ combat diseases

Evaluation

When the lesson is completed the teacher should pin up the cross word puzzle which is already drawn on a large sheet of paper. The clues should also be pinned alongside. The students should work out the puzzle as an evaluation exercise. It should be attempted by all students and the teacher should help wherever necessary.

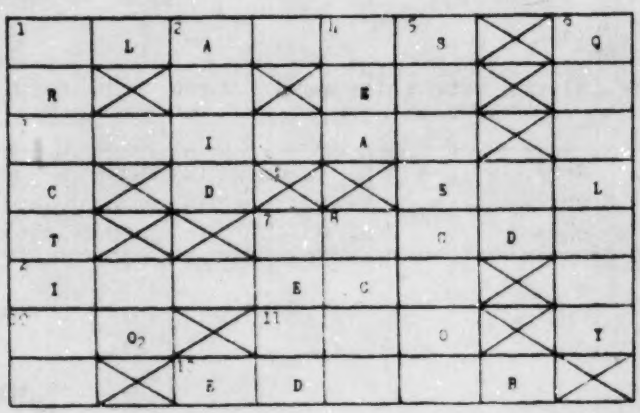
Clues Across

1. These are the primary producers of food.
3. This converts the food made by plants into a type of food which many people prefer.
6. The one that feeds on plant does a great deal of damage to it.
8. This jumbled word denotes soil which lacks lime and gradually becomes ..... or "sour".
10. If plant life is destroyed to a large extent this in the air is bound to increase.
11. The reverse of this is the form in which most minerals are found in the soil.
12. The word for "selected type of animals" is in a jumbled form.

Clues Down

1. Agricultural ..... varies from place to place.
2. This zone in our country has a low rainfall and is unsuited for agriculture.
4. The commercial crop which is the highest foreign exchange earner.
5. We always choose the best variety of seed for better production. The person who does this could be referred to as the .....
7. The control of this and the pest are very important for a successful harvest.
8. The yield of grains is measured in terms of bushels per this.
9. Man is now not only concerned about the amount of food produced, but also about this.

Evaluation for the class



Solutions

plants	practice
animal	arid
acid	weed
insect	tea
CO_2	acre
breed	selector
are	quality

Excerpted from: Sri Lanka. Ministry of Education. Curriculum Development Centre. Population Education Unit. *Man's influence on the resources and the environment; a population education learning unit.* Colombo /1976/, p. 61-71.

CONTENT : CONSEQUENCES OF MAN'S ATTEMPTS AT INCREASING HIS FOOD SUPPLY ON THE BIOSPHERE

OBJECTIVES:

1. *To identify how extensive cultivation results in deforestation and the loss of wild life habitat.*
2. *To identify examples from local situations of how deforestation results in soil erosion.*
3. *To be able to show how the use of fertilizers causes soil leaching and pollution of water.*
4. *To explain how methods of irrigation have produced soil unfit for cultivation.*
5. *To be able to comprehend the relationship between the use of pesticides, weedicides and some of their consequences on plants and animals.*
6. *To be able to comprehend the impact of development and modern agricultural practices on the environment.*
7. *To be able to appreciate the need for conservation of useful plant and animal life.*

GRADE LEVEL: MIDDLE AND HIGH SCHOOL

SCOPE & SEQUENCE NO.: IV.D.1; IV.D.4 IV.D.5; IV.D.6; IV.D.9

Preparation of materials needed:-

One copy each of Spring Boards I, II, III, IV and V should be available beforehand. These could be handwritten or typed. Seek the help of pupils to have the Spring Boards written out.

The Evaluation sheet in the form of a chart should be drawn on a large sheet of paper by the teacher.

Procedure:

Step I

The teacher begins the lesson by recalling the facts learnt by pupils in the previous lesson. The pupils have an understanding of:-

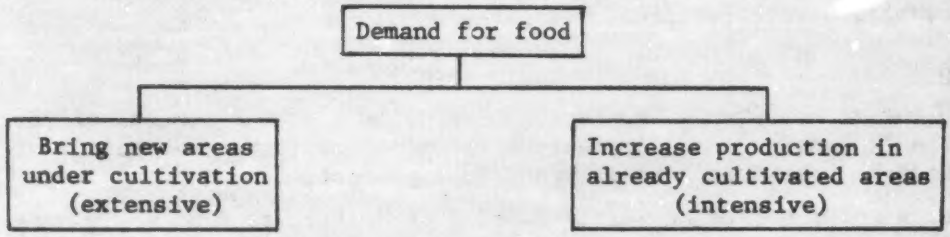
- man's demand for food
- methods adopted by him to increase production
- impact of these methods on plant and animal life.

The teacher while discussing these in brief, builds up a diagram on the chalk board.

E.g. Pose a question such as "Why did man have to increase the supply of food?" The response may be "more food is needed to feed the growing numbers". This could be written on the chalk board as "demand for food".

Next question could be "To satisfy his need what did he do?" This would include the two methods adopted by man to increase food production namely extensive and intensive cultivation.

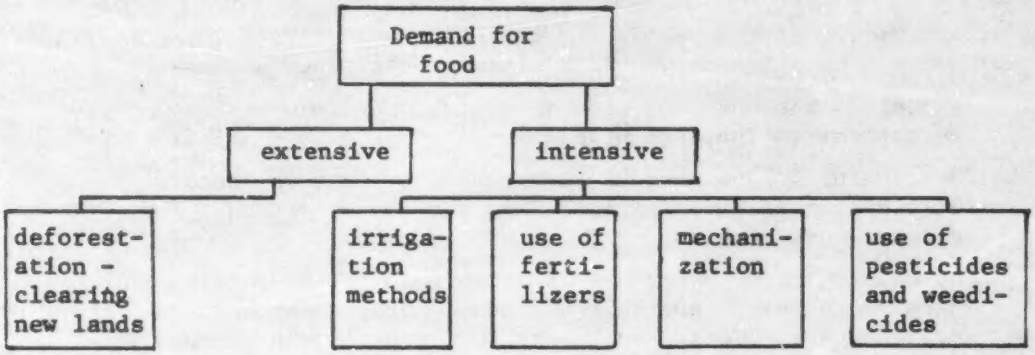
The diagram on the chalk board could be as follows:-


Demand for food
Bring new areas under cultivation (extensive)
Increase production in already cultivated areas (intensive)

The teacher should now build up the lesson with questions such as:

1. What did man do to bring new areas under cultivation?
2. What are the intensive methods adopted by him to increase production?

The responses to these questions would go as cages below the above diagram and could contain the methods such as follows:



Step II

At this point the teacher should get on to the new lesson on the consequences of man's actions in his attempt to increase food supply.

In his sincere attempt to produce more food the actions of man have resulted in certain consequences. There are always the good effects of man's actions as well as the bad. Though the beneficial effects have helped to better our lives the ill effects are fast outnumbering the benefits and soon we may be faced with evil consequences which we may find difficult to overcome or remedy.

Before the pupils get down to discussing some consequences and building up the diagram on the chalk board, the teacher should hand out the Spring Boards to the groups.

Step III

The pupil materials are in the form of passages with questions. The pupils are not expected to write the answers to these. But discuss in the group and note down if necessary the responses which should ultimately go into the cages to build up the diagram, on the chalk board.

The teacher divides the class into 5 groups. Each group is handed one copy of a Spring Board. The group leader could read the passage to the others and each group tries to find the consequences of the methods adopted by man to increase food production. The teacher's help should be solicited when required.

Step IV

When the groups stop work, the teacher calls upon the members of the groups to mention some consequences of man's action as a result of the methods he has adopted to increase food production.

Group A which worked on Spring Board I on 'deforestation' would have arrived at soil erosion as a serious consequence of man's action. The teacher should elicit this from the group and write it in a cage in the diagram, below the cage 'deforestation'. The teacher would also include any other suggestions by pupils e.g. loss of wild life habitat.

Similarly, the teacher should write down in brief the responses of the groups and build up the lesson by completing the cages - (see annexed diagram).

Step V

Referring to the diagram again the teacher should direct the pupils to think of ways in which man could minimize these repercussions.

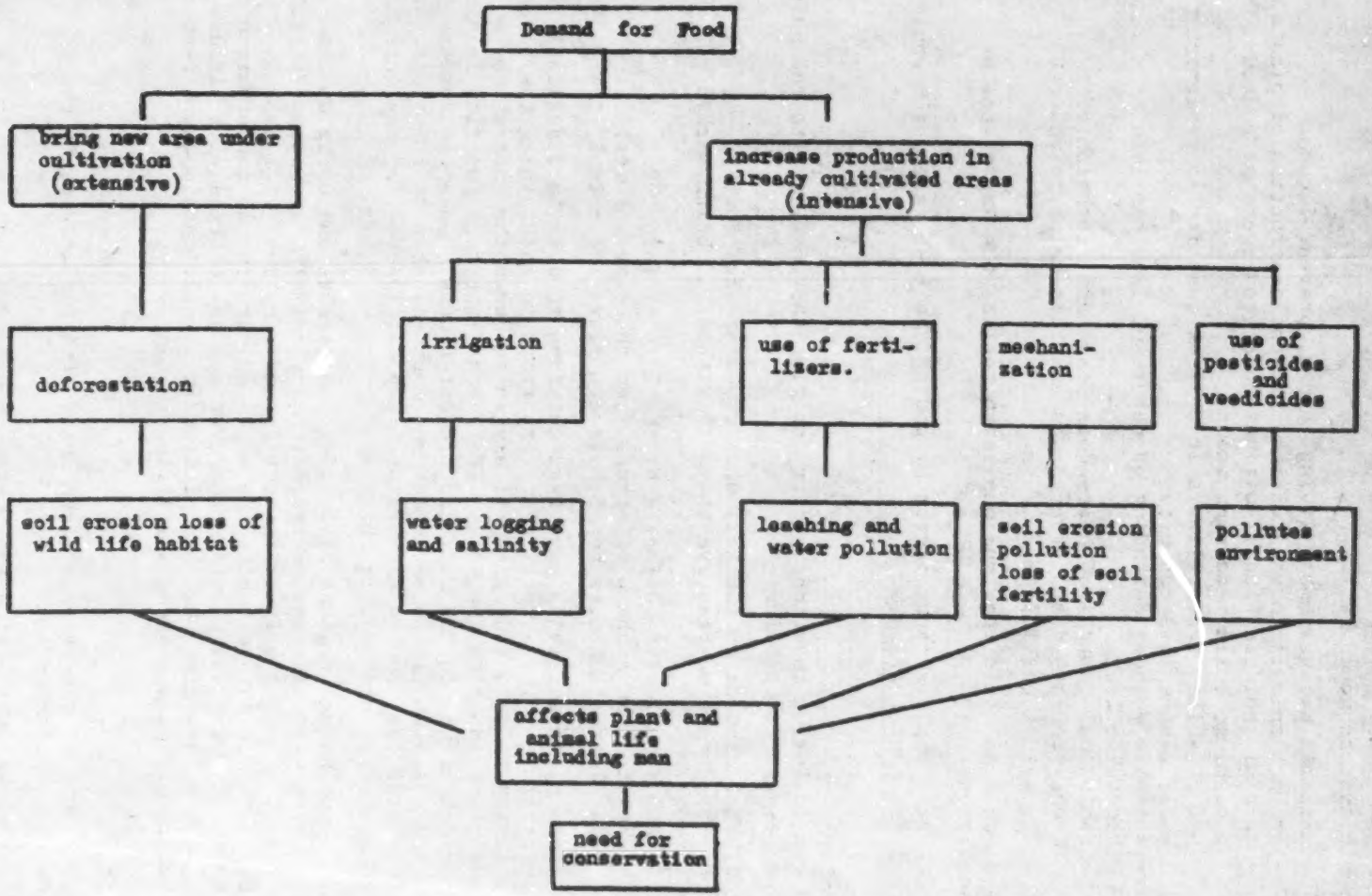
> As long as the need for food is there, man discovers new methods to increase production.
>
> These methods have certain repercussions. But we cannot refrain from cultivating more land nor can we afford to ignore new methods.
>
> The only thing we could now do is to think of preserving whatever resources are left and adopt methods which would do least harm. Today people are conscious of the changes man brings about in the environment and some of its consequences. The forests, soil and water and the animal life that depend on these should be cared for if the earth is to continue to be a pleasant place for mankind.

Instil in the pupils an understanding of the value of our resources and the need to conserve them.

Elicit from pupils answers to questions such as:-

1. Why should we protect our forests?
2. How do we preserve wild life habitats?
3. How can we prevent soil erosion?
4. Why is it necessary to test the soil before using manure?
5. Why is it important to select suitable methods of irrigation?
6. How can we minimize the harm done to nature by the use of pesticides?

recall


Demand for Food
bring new area under cultivation (extensive)
increase production in already cultivated areas (intensive)
deforestation
irrigation
use of fertilisers.
mechanization
use of pesticides and weedicides
soil erosion loss of wild life habitat
water logging and salinity
leaching and water pollution
soil erosion pollution loss of soil fertility
pollutes environment
affects plant and animal life including man
need for conservation

consequences

Probable answers would be:

- maintain balance among living things; prevent floods.
- protect animals in sanctuaries; prevent destruction of plants.
- careful choice of land; cultivation of cover crops; contour ploughing; build retaining walls.
- use of suitable fertilizers in correct quantity to replenish soil; causes less run off.
- suitable methods depending on nature of land has less harmful effects.
- biological control of pests does less harm; rotation of crops prevents disaster by pests and this helps to reduce the use of pesticides.

This discussion would lead the pupils to realize the importance of conservation.

The teacher completes the diagram by adding the last cage which would be need for conservation.

Spring Board I

Read the following questions and try to find the answers with the help of the passage given below:-

1. What happens to the soil when trees are cut down?
2. Why should we preserve the soil without it being washed away?
3. How is wild life affected by the loss of forests?
4. Try to form a chain of events from the time a forest is cleared and note how it affects plant and animal life.

Vast areas of forest lands have been cut down to make land available for agriculture. These forests are important in maintaining the balance among living things; they give off oxygen and when they decay they restore plant foods to the soil. Their most important function is that they hold moisture in the soil and prevent floods. Once the forests have been cut down floods may occur and much valuable soil is lost. In some parts of the tropics an acre of hilly cultivated land may lose 100 tons of soil per year in this way.

As man occupied new regions by cutting the forests and using up the plains, much wild life was destroyed. Many animals have become extinct as a result of man's wilful destruction and many more will become extinct if we do not recognize the need for care in the conservation of our native animals and plants. Wherever man has entered with his axe and plough he has disturbed the plant-animal relationship which results in the proper balance among all living things.

Spring Board II

With the help of the passage given below find the answers to the following questions:-

1. How has the irrigation system in our country helped to increase production?
2. How does irrigation cause salinity of the soil?
3. What happens when the drainage system is disturbed?

Irrigation which agricultural man practised as early as 6,000 years ago has played a great role in increasing food production, by bringing into profitable cultivation vast areas that would otherwise be unusable.

The many irrigation methods adopted by man have resulted in the reshaping of the water cycle which has had unwanted side effects. One is the raising of the water table caused by the disturbance of the drainage system. After a period of time due to accumulation of water underground the water table may rise to a few inches of the surface. This not only obstructs the growth of plant roots by water logging, but also results in the surface soils becoming salty as water evaporates through it leaving a concentrated deposit of salts in the surface. Such a situation developed in West Pakistan after its fertile plain had been irrigated with water from the Indus for a century. This has been repeated many times throughout history in various countries of the world.

Spring Board III

Read the following questions. Try to find the answers to these with the help of the passage.

1. How is underground water polluted by chemical fertilizers?
2. What effect does run off of chemical fertilizers have on rivers and lakes?
3. Can you think of any examples of dying water bodies in your area?
4. Does this effect the fauna and flora in your region?

Chemical fertilizers did not come into widespread use until this century. The pressure of population and the disappearance of new lands forced farmers to substitute fertilizers for the expansion of crop lands to meet growing food needs. Experience has shown that proper utilization of water and fertilizer with other inputs and practices can double, triple, or even quadruple the productivity of intensively farmed soils.

The use of fertilizers has benefited man enormously. But the benefits are not without side effects. The run off of chemical fertilizers into rivers, lakes and underground waters create two important hazards. One is the chemical pollution of drinking water. In certain areas the nitrate content of well water has risen to toxic levels. The other, a much more extensive hazard, is when inorganic nitrates and phosphate discharged into lakes and other bodies of fresh water provide a rich condition for the growth of algae. This in turn depletes the water of oxygen and thus kills off the fish life. This slowly brings about the death of the lake and converts it into a swamp.

Spring Board IV

Read the following questions. Find the answers with the help of the passage given below:-

1. How does mechanization cause soil erosion?
2. How does its ill effects weigh against its benefits?
3. Does mechanization suit your area? Why or Why not?

Mechanization has helped to bring under cultivation large extents of lands which helped to produce more food for the fast increasing human population. The replacement of animals by machinery has also helped in cultivating a number of crops in a year. The invention of the internal combustion engine and the tractor has been a great breakthrough in agricultural practice.

The early farming methods did little harm to the land. It took hours of hard labour to plant and harvest an acre of crop. Today the picture has changed. A tractor purrs over an acre of ground hauling many ploughs

which dig deep into the top soil. The same acre that used to require hours of labour now takes less than a few hours.

But power machinery for all the boon it has been in increasing the food supply has played its part in causing soil erosion. Land which is dug up and broken into tiny bits by power machines is easily eroded by water and winds. These machines also pollute the air with the poisonous gases they emanate. Moreover with a quick succession of crops at short intervals the soil loses its fertility faster than it normally would. This will have to be replaced with the addition of fertilizers which would be an additional expense to the farmer. In many countries the machinery has to be imported and large sums of money is spent on these, whereas cheap labour goes unused. In the Asian region where land is fragmented into small holdings mechanization proves uneconomical.

Spring Board V

With the help of the passage given below, try to find the answers to the following questions:-

1. Do you think it is possible to cultivate crops without the use of pesticides today?
2. Why is DDT considered dangerous?
3. How do pesticides and weedicides affect the environment?

One of the outstanding developments of the 20th Century has been man's success in combating and controlling the many competitive weeds and agricultural pests. Yet this has not been achieved without some threat to man and his environment.

Left to nature's own will the natural biological control exerts an influence on the unlimited growth of any one species. But due to man's intervention and modern agricultural patterns this balance has been upset and the necessity to use pesticides for controlling unwanted plants and diseases and insect pests has greatly increased.

The detrimental effects of many agricultural chemicals might well outweigh the benefits derived were they not used with forethought and care. Though the majority of these are turned into harmless end-products and absorbed by the environment, others persist for years or decades accumulating in dangerous concentrations and providing a continued threat to normal growth.

DDT was found in the tissues of animals over a global range of life forms. Carnivores are particularly likely to concentrate DDT in their tissues because they feed on herbivores that have already concentrated it from large quantities of vegetation.

In the practice of monoculture it has become necessary to spray pesticides and weedicides at regular intervals. This when done from the air pollutes the environment causing considerable damage to other plant and animal life of the area, which are vital to maintain the balance of nature.

Evaluation

Have the following chart drawn on a large sheet of paper and pin it up on the chalk board. The chart consists of 3 columns.

The first column gives the actions of man in his attempt to increase food production.

The second column gives the possible consequences of his actions. The third gives methods of conserving our resources from being destroyed.

Instruct the pupils to look at the chart and note down the matching items in each column.

E.g. item No.4 in column I has as its consequence - item No. 1 in column II. Method of preventing this and conserving the resources is given in item No.4 of column III. So the answer could be written as 4 - 1 - 4. Similarly request the students to match the other items in the chart.

The answers are:-

1 - 5 - 2
2 - 4 - 1
3 - 2 - 5
4 - 1 - 4
5 - 3 - 3

(These items could vary slightly depending on the local situation)

EVALUATION

Man's Actions	Possible Consequences	Methods of Conservation
1. - cutting down forests for agriculture.	1. - water logging salt deposits in soil.	1. - use of pesticides and weedicides.
2. - monoculture.	2. - destroys useful organisms.	2. - careful choice of land. - cultivation of cover crops. - contour ploughing. - build retaining walls.
3. - use of insecticides, weedicides.	3. - water pollution by chemicals.	3. - minimize use. - soil testing and use of suitable manure. - clean up water bodies to prevent stagnation.
4. - new methods of irrigation	4. - increase growth of pests and weeds.	4. - care and forethought in adopting methods of irrigation to suit nature of land.

Man's Actions	Possible Consequences	Methods of Conservation
5. - use of fertilizers.	5. - soil erosion. - silting. - floods.	5. - use of chemicals which are selective in their action. - using alternative methods of biological control. - rotation of crops.

Excerpted from: Sri Lanka. Ministry of Education. Curriculum Development Centre. Population Education Unit. *Man's influence on the resources and the environment; a population education learning unit.* Colombo [1976], p. 73-84.

CONTENT : POLLUTION OF THE ENVIRONMENT: PROPER MANNER TO USE WATER FOR WASHING AND DRINKING

OBJECTIVES:
1. *Discriminate among different types of water.*
2. *Identify at least one source of potable water.*
3. *Identify different uses and qualities of water.*
4. *Identify different water pollutants.*

GRADE LEVEL: LOWER PRIMARY/UPPER PRIMARY

SCOPE AND SEQUENCE NO.: IV.D.7

Lesson I

The teacher showed the students three glasses: in one there was obviously muddied, brackish water; in other fresh, potable water and in the third white vinegar (water with a little vinegar, or a glass of tea could also be used.) Without allowing the children to touch or smell the glasses, the teacher asked them which ones they would like to drink. Answers were charted on the chalk board. The teacher asked several children why they made a particular choice.

Then the children were told what was in each glass and several children smelled the white vinegar. The teacher reminded the students that, if possible, they should be careful about drinking water. The students were assigned "homework", to ask their parents:

1. What are three places where people can get water? (e.g. spring, well, rain.)
2. What is at least one source for good drinking water? (As an alternative children could ask parents to tell about one way to make water safe for drinking.)

Answers were collected and examined by the whole class the next day.

Lesson II

The teacher put clean water in a large glass (or glass container). Materials and pollutants found around the school such as dirt, food scraps, grass, bits of paper, were gradually added to the water. The water after a few days was quite dark and odorous and the children were asked about some of the changes they saw in it:

What do you think caused the changes?
Have you ever thrown one of these pollutants or others in a body of water?
Do you think that what you threw made any difference to the freshness of the water - especially since there was so much water?

Taking a clear glass of water, the teacher asked the children to pretend that it was a lake. Then the teacher put in a drop of ink. Noting that the colour of the water had barely changed with this "pollutant", several students put in a drop of ink each. The class noted how dark the "lake" became - too dark for drinking or swimming. The teacher asked:

> Since each of us only put in one small drop,
> why is the lake so dirty?
> Why is it important for <u>each of us</u> not to be
> a water polluter?

The teacher then asked several students to tell one thing that people sometimes do that pollutes water.

CONTENT : ENVIRONMENTAL IMPROVEMENT: USING LAND RESOURCES

OBJECTIVES:
1. *To investigate man's basic needs and population increase in relation to land.*
2. *To develop understanding of the need for optimum utilization of land and its environmental improvement.*

GRADE LEVEL: HIGH SCHOOL

SCOPE & SEQUENCE NO.: IV.E.4

Activity

The sub-section entitled Land as a resource provides examples of the different teaching approaches used in this unit. The first of the two lessons in this sub-section is Man needs land for his existence. Students investigate man's basic needs and population increase in relation to land use in this lesson. Included is a role-playing activity which is summarized in the following paragraphs.

The lesson starts with a discussion taking place in a village council. At the end of the discussion, the class is expected to state the different purposes for which land is used in their village or town.

Five pupils are selected from the class to represent the members of the village council. One of them plays the role of the Chairman and the others are named the first member, second member and so on. Cards containing the main points on which the members will speak are shown on the opposite page. These cards are given to the selected pupils. The pupils are briefed before the lesson so that they can come prepared for the discussion.

Before the discussion, the teacher tells the class that they are going to study about land use. He/she mentions that a discussion in the form of a village council meeting will take place. The students are expected to follow the discussion closely with a view to finding answers to the question:

What are the different ways of using land as mentioned by the village council members in their discussion?

At the beginning of the village council meeting, the Chairman states that the day's business will be the discussion of a proposal made by the first member of the Committee (see Card I - for the Chairman).

The first member proposes that the Council acquire some land between the temple and the cemetery to be converted into a playground. Both the first and second members support this proposal with various arguments (see Card II and Card III). If the playground used in this example is inappropriate, the lesson writers suggest that a land-use issue more relevant to the village or town be chosen, e.g. market place.

The members opposing the proposal can say that the land should be put to other more important uses since the village has only about 50

acres under paddy and there are many people without proper houses (see Card IV and Card V).

The Chairman can make his own comments and all members are encouraged to formulate their own arguments and land-use ideas. The teacher whose role is that of a consultant (Card VI) introduces any other facts relevant to the discussion. It is suggested that the discussion lasts about 15 minutes.

At the end of this activity the proposal is discussed by the class and the different types of land use mentioned for the village are listed. Examples of these may include: temple, cemetery, school, road, library, paddy fields and so on.

For teachers who feel that this role-playing method is too difficult, an alternative method is provided. It makes use of a table to be filled out by the whole class regarding types of land use in their town or village.

Following this role-playing activity (or the alternative), the teacher and class identify other types of land use not found in the village, such as railways, factories, bus stands, hospitals and so on.

Then, attention is turned to how early man, who lived thousands of years ago, used land. Based on simple student reading material the class discusses how primitive man hunted animals, gathered fruits for his food and wore clothes from the immediate environment.

Students compare the way early man and present-day people use land. Pupils may also think of possible land uses in the future. It becomes obvious that modern man uses land for more purposes than did primitive man and that the demand is likely to increase in the future.

At the end of the activity, short reading passages are provided about the demand for food in relation to an increasing population, improvements in health care and expansion of health facilities, expansion of the school system and transportation networks. Based on these, students investigate reasons for increasing demand for land. Probable reasons will include:

- increased population
- need for more hospitals
- need for more schools
- increased demand for food
- modern means of communication and transportation.

Summing up the lesson, the teacher may note that all these reasons for the increasing demand for land relate to three broad areas:

a) increasing population
b) improved technical knowledge
c) improved standard of living.

Card I – for the Chairman

You are the Chairman of the Village Council

As the Chairman you are expected to do the following in addition to your normal duties (such as maintaining discipline and order in meetings).

1. At the beginning, you should tell everyone that the main business for the day will be a discussion on the proposal made by the first member.

2. In the course of the discussion you should emphasize that:

a) putting a proposal into action always costs money.

b) priority should be given to important things, in the order of their need in the village.

c) it is necessary to allot some money for the widening of the road as the bus service to the village will be improved by the addition of two more buses from the following month.

Card II – for the First Member

You are the first member of the Village Council

You should propose that the land between the temple and the cemetery should be acquired by the Village Council to be converted into a playground.

In your discussion you should quote examples from nearby villages that have better facilities such as libraries, weaving centres, playgrounds. Emphasize why a playground is important for the village.

Card III – for the Second Member

You are the second member of the Village Council

You are expected to support the proposal of the first member.

You should say that, as the village council had built a community centre and a school the previous year, attention should now be devoted to the preparation of a playground this year.

Card IV – for the Third Member

You are the third member of the Village Council

You should oppose the proposal made by the first member.

In opposing this proposal you should show that the new land should be used for paddy cultivation or for some other food crops because only 50 acres of paddy have been farmed in the village. There is enough water for 100 acres of paddy in the village water tank.

You may also suggest that a dispensary or clinic could be more useful than a playground.

Card V – for the Fourth Member

You are the fourth member of the Village Council

You are expected to oppose the proposal of the first member.

You should argue saying that the new land should be used for a housing scheme, because there are many families without proper houses.

You may also mention that the village school needs some more classrooms.

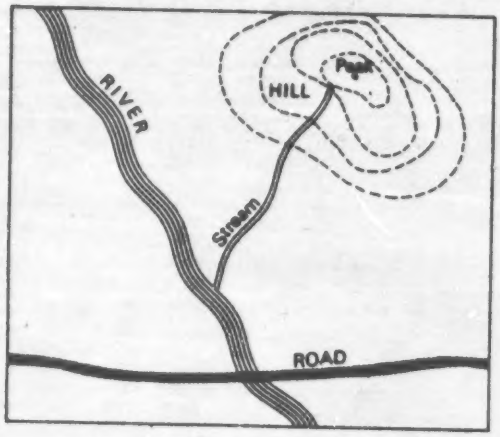
Card VI – for the Teacher

You are the consultant to the Village Council

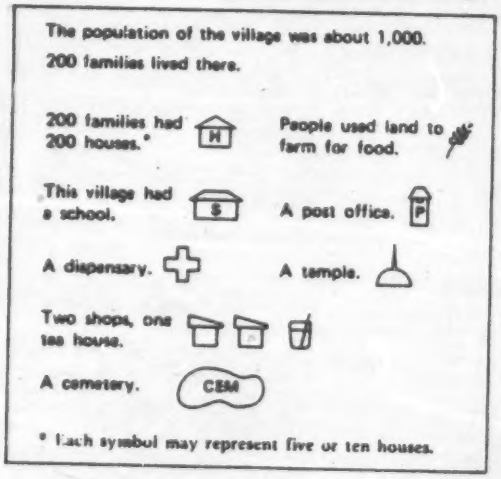
If the discussion is not progressing in the expected manner, you should intervene and ask questions and guide the committee to proceed with the discussion to bring about the expected outcomes.

Changing land use and population

The second lesson in this sub-unit is titled *Land as a finite resource*. Its concepts relate to the shrinking amount of unused land on earth and changes in land use resulting from changes in population. In addition, the lesson emphasizes that many factors--including future community needs--should be taken into account when decisions are made about using land. In this lesson children complete a map for a village over a 30-year period and they identify changes in the village. Students are given a simple map to discuss, showing a village with a few details such as a hill, river, road and a stream.



Then they are given a list of things found in the village 30 years ago. Using symbols the students fill in the map taking care to consider carefully where the houses and schools will go.



Over a 30-year period from 1947 to 1977, conditions changed a great deal and, among other things, the population doubled. A second list giving information about the village in 1977 is shown to the students.

Students compare the information on the two lists and then complete the map to show changes over the 30-year period in a different colour.

There are 400 families with a population of about 2,000.
200 more houses have been built.*
H
More land is used to give food.
Another building has been added to the school.
S
The road has been widened.
A new road is built to join the main road.
The following have also come up:
A police station.
PS
A market place.
M
A playground.
PG
A bakery.
* Each symbol may represent five or ten houses.

In their discussions of the map, certain things may become obvious. For example, the land in the village is limited and as the number of people increases so the use of land increases. Land in the village is used in many different ways. There is a need to plan now for the future use of the shrinking resources.

This part of the lesson should provide students with practice in map reading and use of symbols. This section also addresses what has been called the timeline problem in population education; that is, the comprehension of changes over an extended time period by children who naturally have little past history themselves.

From this point in the lesson, the class proceeds to examine the land resources of the world and their country.

For further information about these teaching materials, the reader is invited to write to the Unesco Regional Office.

Article taken from: *Population education in Asia Newsletter* (7): 8-10, June 1977.